

E-LEARNING SYSTEMS, STANDARDIZATION AND UNIVERSITY PRACTICE

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ABSTRACT

In this research, we will show the importance of interoperability in the development of e-learning from standards and standards especially in higher education. Thus, we will deal with the planning of the enhancement of an ILE, the writing and presentation of teaching materials, the management of identity and access to resources, the sharing and archiving of teaching materials and in the end the addition of new technopedagogical tools to EIAH.

KEYWORDS: *e-Learning Systems, Interoperability, Standardization Matter & University Practice*

Received: Mar 09, 2019; **Accepted:** Mar 29, 2019; **Published:** Apr 16, 2019; **Paper Id.:** IJESRJUN20192

INTRODUCTION

E-learning systems are an important educational advance. It uses the Web (hypertext structure, multimedia capabilities, etc.) As a support for dissemination of knowledge and interaction between the different actors (teachers, learners, tutors, administrators,...). Several e-learning platforms have been developed and several are available on the open web. These platforms are environments that allow a teacher to easily create and manage learning situations on the Web, leaving him free choice of models, strategies and methods that are on the side of teaching that that of learning. They also offer synchronous or asynchronous communication tools (videoconferencing, discussion forums, chat, email, document transfer ...), evaluation tools (tests, exercises, surveys, works,...), and the possibility of depositing educational resources (PDF files, video sequences,...). Thus, the main function of e-learning platforms is to provide the learner the right activities with the right tools at the right time according to his needs. This requires the application of mechanisms for coordinating and coordinating modules and pedagogical activities. If an e-learning system is a collection of activities or processes, we can split its functionality into a number of stand-alone functions that can then be performed separately as stand-alone applications or e-services, using Web services technology.

This requires us to take into account the heterogeneity of the different information systems used. Systems typically need to communicate, exchange information and resources in the form of programs, data or services. The field of e-learning is one of the largest research areas currently undertaken mainly in Artificial Intelligence (AI) and Information Systems (IS). The field in general, is supported by SI which are structured particularly around the formations, in order to support the storage, the access, the diffusion and the sharing of information relative to the various actors of the educational act. The information comes from many heterogeneous sources distributed, produced, and managed autonomously by different institutions.

This work concerns the proposal of examples of practices of standards and standards in e-learning in institutions of higher education. Indeed, four broad categories of needs justify the use of standards and standards of e-learning based on the six fundamental characteristics sought by different actors in terms of standardization in e-learning. The first category concerns the standardization of educational content. The second category concerns university business management, in particular the exchange of information with the academic management system and other institutional systems. The third category concerns standardization of learners' e-Portfolios; and the fourth category is the deployment of flexible, scalable, open and supportive educational and presentation environments for teaching materials that support the sharing of applications in support of research activities.

In this research, we will show the importance of interoperability in the development of e-learning from standards and standards especially in higher education. Thus, we will deal with the planning of the enhancement of an ILE, the writing and presentation of teaching materials, the management of identity and access to resources, the sharing and archiving of teaching materials and in the end the addition of new technopedagogical tools to Computer Environments for Human Learning (EIAH).

E-LEARNING SYSTEMS AND STANDARDIZATION

At the international level, the existence of numerous initiatives clearly demonstrates the importance of interoperability, accessibility, portability, sustainability and sharing of learning content. The standards, specifications and standards specific to e-learning published have also greatly matured in recent years. The table 1 illustrates the six fundamental characteristics sought by different actors in terms of standardization in e-learning (Introducing the ADL Initiative⁽¹⁾).

Table 1: Fundamental Characteristics of Standardization in e-Learning

Characteristic	Function
Interoperability	The ability to take a course in one system and rebroadcast it into another system.
Accessibility	The ability to locate and access educational materials provided by many and disseminate them elsewhere..
Reusability	The ability to reuse course components in other applications, courses, and contexts.
Sustainability	The ability to persist despite technological changes over time, without the cost of reconversion
Maintainability	The ability to support the constant evolution of low cost educational content.
Adaptability	The ability to serve a diversified clientele, technologically and according to their needs.

Based on quality benchmarks that are used in the activities to allow a given system to position itself against pre-established objectives. These are the tools used to improve quality. The examples of repositories are multiple in the field of education. They are increasingly adopted across countries and regions and tend to become international in scope thanks to international e-learning standards and standards. Thus, the various authorities multiply their efforts for the development of standards, norms, standards and rules of good practice that become a criterion of quality inherent to the concerns of interoperability and compatibility and which are increasingly sought after between the educational systems of the world. In this work, we take into consideration some contexts of repositories

- The Canadian Joint Committee on Standards in Educational Assessment (JCSEE); ⁽²⁾
- The report of the Working Group on Interoperability between Digital Learning Environments; ⁽³⁾
- The quality manual for e-learning in higher education (E-xcellence); ⁽⁴⁾
- The Canadian Recommended E-Learning Guidelines; ⁽⁵⁾
- The reference guide for FFFOAD best practices ⁽⁶⁾

Based on the work and reports of these different organizations, four main categories of needs justify the use of standards and standards of e-learning based on the six fundamental characteristics sought by different actors in terms of standardization in e-learning. Learning. Thus, we have identified:

- the most relevant standards and specifications;
- their context of use and their purpose;
- their functions and roles.

The first category concerns the six fundamental characteristics sought by different actors in terms of standardization of educational content. Table 2 illustrates this standardization.

Table 2: Standardization of Educational Contents

Function / Role	Context of use	Standards and Specifications
Ensure the portability of evaluations, reviews and related results.	Creation of assessments and exams that the teacher can deploy on any platform that complies with the standards and standards in force. Migration of quizzes from one platform to another	Question & Test Interoperability (IMS)
Skeleton coding strategies and learning objectives.	Creation and documentation of educational strategies	IMS Learning Design
Ensuring the technical portability of teaching modules.	Moving a complete educational module from one runtime environment to another • Creation, using authoring tools, self-supporting teaching modules that can be deployed and run on any platform compliant with the standards in force. Deployment and execution of an educational module from a content editor (publishing house, authors, teachers, etc.).	IMS Content Packaging IMS Common Cartridge ADL Shareable Courseware Reference Object Model (SCORM 2004)
Metadata about educational content	Referencing, sharing and finding learning resources through repositories.	Learning Object Metadata (IEEE - LOM)

The second category concerns university business management, in particular the exchange of information with the academic management system and other institutional systems. Table 3 illustrates this standardization.

Table 3: Standardization of University Business Management

Function / Role	Context of use	Standards and Specifications
In the context of higher education institutions where broadband exchange is required, it is important to structure the way systems manage the exchange of information that describes individuals, groups, the statutes specific to the academic context.	Structure the exchange of data between the different management systems within the University: <ul style="list-style-type: none"> • the study management system; • the human resources management system; • the course management system; etc. 	IMS Enterprise; EduPerson.

The third category concerns the six fundamental characteristics sought by different actors in terms of standardization of learning e-Portfolios. Table 4 illustrates this standardization.

Table 4: Standardization of Learners' e-Portfolios

Function / Role	Context of use	Standards and Specifications
More and more digital portfolio tools are beginning to incorporate standards to facilitate system interoperability and data accessibility and archiving.	The different types of portfolio: <ul style="list-style-type: none"> • Competency assessment; • Presentation: enhancement of the student; • Personal, educational and professional development; • Learning, school path, training, etc .; • Project, several owners. 	IMS ePortfolio

The fourth category is **Deploying Presentation and Execution Environments for Learning Materials** Flexible, Scalable, Open, and Application Sharing. Table 5 illustrates this standardization

Table 5: Standardization of Deploying Presentation and Execution Environments of Learning Materials

Function / Role	Context of use	Standards and Specifications
Mechanism for integrating tools from third parties into the core learning management system (LMS).	Addition of add-ons to the learning management system, modules developed by third parties (open source or owner).	IMS Tools Interoperability (TI)

Therefore, in order to meet the needs expressed by all stakeholders with an interest in standardization and the emergence of multiple norms and standards, academic institutions will have to seriously consider the following two entries

- Develop a presentation and execution environment that can accommodate standardized learning content from another institution or content producer;
- Support the development of teaching materials using authoring tools that produce content in reusable and standardized formats.

PRACTICE IN INSTITUTIONS OF HIGHER EDUCATION

The aim of the Computer Environment for Human Learning (EIAH) is to support and motivate human learning (TChounikine, 2002a⁽⁷⁾), by offering software and human agents the conditions of interaction and learning conditions, access to educational resources. This field has experienced a significant growth in terms of use in initial training and continuing education.

The acronym EIAH denotes an evolution of ideas from programmed teaching to computer assisted teaching, then to computer-assisted teaching, then to the interactive computer assisted environment, and currently, the computer environment for human learning

It is a multidisciplinary field of research involving computer science and several other disciplines: pedagogy, didactics, cognitive psychology, education sciences, ergonomics, information and communication sciences, etc. and that covers a variety of systems: open and remote training platforms, hypermedia systems, intelligent tutors, etc. The design of such systems requires taking into account a multitude of interrelated issues (Chounikine, 2002b⁽⁸⁾).

The Computer Environment for Human Learning brings together all the applications and computer software used for teaching and learning. The term encompasses both learning management platforms (LMS) and content management platforms (LCMS) as well as software tools. In academia, the digital learning environment supports classroom training, hybrid training, and distance learning via the Internet, internships, networking, and dissemination of media-based educational resources and, in some opportunities, in support of research activities.

In this section, based on further work, we will show the importance of interoperability in the development of e-learning from standards and standards especially for higher education. For example, we will be dealing with planning for the enhancement of ILE, writing and presenting educational materials, managing identity and access to resources, sharing and archiving educational materials, and adding new techno pedagogical tools to EIAH (Ettaib et Khaldi, 2018⁽⁹⁾ ; Jeffrey, 2016⁽¹⁰⁾ ; Diakhaté, 2014⁽¹¹⁾ ; Ettaib et al, 2014⁽¹²⁾;

Bergeron et al, 2011⁽¹³⁾, Marquet, 2011⁽¹⁴⁾ ; Zghidi, 2010⁽¹⁵⁾ ; Trouche. 2007⁽¹⁶⁾ ; Blandin, 2007⁽¹⁷⁾ ; Broisin, 2006⁽¹⁸⁾ ; Ferraris et al, 2005⁽¹⁹⁾ ; Oubahssi, 2005⁽²⁰⁾ ; Burgos et al, 2005⁽²¹⁾ ; Abel et al, 2003⁽²²⁾ ; MORLEY, 2001⁽²³⁾ SÉGUY, 1999⁽²⁴⁾).

The Importance of Standards and Standards for Higher Education

Standards and standards for digital learning environments are at first glance complex, as we have just seen. A simple solution to the problem of Information Technology⁽²⁵⁾ (IT) environments for higher education is to hope that a single system can accomplish all the tasks of an EIAH. We will therefore seek a multidisciplinary system, powerful, integrative, easy to use and above all respecting the economic constraints of universities and institutions of higher education.

However, this goal is unrealistic in many ways. An overview of the diversity of actors and systems involved in an ILEH illustrates the complexity of the problem. Let us first look at the different actors and systems involved in an EIAH. We will classify these different actors in three categories, a first category concerns all resource actors (publishing houses and libraries), the second category concerns pedagogical actors (teachers and learners) and the third category concerns administrative actors (services students and computer services). Table 7, 8 and 9 illustrate the different actors and systems

involved in a human learning computing environment.

Table 6: Resource Actors Involved in a Human Learning Environment EIAH

Acteurs	Tasks	Incoming Elements	Elements Produced	Systems Involved
Publishing houses	Distribute books and accompanying teaching materials.		Reference material, generic teaching material: course and assessment	Editing system; Production on a CD.
libraries	Manage collections of books and educational and electronic materials	Reference material, teaching material	Reference material, teaching material	Library system; deposit of learning resources

Table 7: Pedagogical Actors Involved in a Human Learning Environment EIAH

Actors	Tasks	Incoming Elements	Elements Produced	Systems Involved
Teachers	In their function of designer: Design or write educational material.	Generic teaching material: courses, references and evaluation	Course materials: courses, references, assessment, lesson plan	Author office system Author's tools Various personal writing tools
	<i>In their corrector function: Correct and annotate the works</i>	School works	Notes Annotated work	Scoring system, academic management system
	<i>In their function of integrator: Identify bibliographic resources</i>	Resources different pedagogical	List of references, courses assembled and validated	File filings Deposit of resources learning
learners	relevant external	granularities		
	Consult the teaching materials; write their work alone or in teams; exchange for their school work; perform assessments	Teaching material for the course	School works, results of the online evaluation	EIAH Servers Local Browser: HTML and Document Reader Reading and annotation of teaching materials Collaboration tools File filings

Table 8: Administrative Actors Involved in a Human Learning Environment EIAH

Actors	Tasks	Inputs	Outputs	Systems Involved
Student Services	Manage identity, courses, learners, group-courses	Enrollment of learners	Lists of teachers, courses and groups	Study Management System
IT services	Control identity, access	Lists of teachers, courses and groups		LDAP server, control server central identity, control server federated identity
	Provide an Environment Human Learning Computing			EIAH system, basic system of data servers application further, Web servers, network services
	Operate environments			

This wide variety of actors and systems indicates that the single-system approach will soon run into concrete problems. Among others:

- The variety of existing systems;
- The different institutional actors already work with specialized computer systems: student affairs with the management system of studies; libraries with information systems; teachers and authors with their workstation (or other tools located on the servers); and learners with their mobile stations, on campus and at home;
- The diversity of pedagogical approaches;
- Depending on the faculties, scientific fields or pedagogical choices specific to a teacher, the use of different tools;
- synchronization of different systems;
- Finally, note a problem specific to the diversity of systems involved. There will be unsynchronized cycles in time for the renewal of different systems and software packages.

On the other hand, this great diversity of actors and system blocks requires links and exchanges defined by standards and standards so that they can interoperate with each other to provide an integrated experience for the users of these services.

This shows that the benefits of mastering a university enterprise architecture based on standards and open standards are many, including interoperability, accessibility, reuse, sustainability, maintainability and adaptability. However, two questions are needed:

- How can this list of standards be transformed into a practical guide for planning the management of different systems in academic institutions?
- How to integrate this range of concerns into an articulated and coherent approach?
- To answer these two questions, let's look at some processes and tasks that will be facilitated with the use of standards and standards. Five things to consider:
- Plan for the recovery of a human learning computing environment;
- Note and present the teaching materials;
- Manage identity and access to resources: teachers, learners, courses (learning situations), group courses;
- Share and archive teaching materials;
- Add new techno pedagogical tools to the human learning computing environment that already exists.

Planning for the Enhancement of a Human Learning Computing Environment

A project to enhance a human learning computer environment will, whatever the solution, plan the tasks. These will be done more easily using a standard. Table 9 shows us all the tasks to be taken into consideration.

Table 9: Planning to Enhance a Human Learning Computing Environment

	Tasks	Standards
Migration and adaptation of the contents of the current EIAH in the new EIAH	Script extraction and migration courses and assessments.	IMS Content Packaging for content; IMS QTI for evaluations
Integration of the human learning computing environment into the institutional environment	Programming and installation of the "Single Sign On".	CAS, SAML, Edupearson
	Programmation de passerelles pour l'inscription automatique des professeurs, des étudiants et des groupes-classes.	IMS Enterprise
	Programming gateways for the automatic insertion of educational information: course description, schedule, calendar.	Web Services, RSS feeds with iCal / vCal
	Establishment of bridges with the different repositories of the institution (filing of files, institutional repository, system of archives, etc.).	IMS Digital Repositories OKI Repository Specification OSID Java Content Repository-JSR

WRITING AND PRESENTING EDUCATIONAL MATERIAL

The diversity of content creation and updating is a central aspect within institutions. The different authors will use not only the authoring system proposed by the human learning computing environment, but also a host of other authoring tools according to their needs and educational preferences. This content must be able to be collected and interoperated to form resources of different granularities (evaluation, modules, self-supporting courses, etc.) that can be disseminated on the Internet in an HTML structure with relative hyperlinks.

Standards on the production and distribution of HTML content will therefore be essential. However, HTML is not enough; for these contents to fit properly, metadata can either be captured through a web interface (in the human learning computing environment or local authoring tools), or generated automatically. Online assessments and exams are used less, but are another aspect of teaching materials. Again, digital learning environments provide tools for editing, assembling, and building quizzes and assessments. However, these environments are minimalist in terms of the ability to produce and manage a bank of questions. For this reason, specialized authoring systems are involved. In any case, it is a long, arduous and difficult task. The investment of time and expertise required by banks of questions leads to more reflection on the methods of construction and the sustainability of these. In addition, appendices to books will likely provide the next generation of quizzes and exercisers that will need to be available in environments.

The standard of exchange between author environments and human learning computing environments for performing assessments (quizzes) is "IMS-Question and Test Interoperability". This standard is essential. There are therefore standards for marking equipment (IEE 1484.12.1-2002 (LOM)⁽²⁶⁾), standards for assembling materials (Content Packaging and / or SCORM), and standards for exchanging evaluations (quizzes) and exercisers (IMS-Question and Test Interoperability). All are essential to ensure the sustainability of the content. These standards are essential for presenting the teaching material. Table 10 gives us some examples of standardized tools.

Table 10: Examples of Standardized Tools

Outils auteurs	Licence	Tâches	Standards
Adobe Presenter	Commercial (Adobe)	Riding a course	SCORM
Articulate	Commercial	Set up a course and quizzes, integrate multimedia	SCORM
eXe ⁽²⁷⁾	Free	Riding a course and quizzes	SCORM, Content Packaging
Reload ⁽²⁸⁾	Free	Make content	SCORM
Respondus	Commercial	Build banks Questions	IMS-QTI
Paloma	Free	Catalog and search for learning resources	IEE 1484.12.1-2002 (LOM)

IDENTITY MANAGEMENT AND ACCESS TO RESOURCES

Teachers, learners, courses and group-courses, one of the essential tasks that the institution must do, when it wants to set up a human learning computing environment, is to manage and control the identity of actors who will use this service and define roles and access permissions to resources. Several systems will be put in place for this purpose, in particular the authentication system that validates the users and the authorization system that controls access to the educational resources. IMS Enterprise is an international XML file format standard that can be used to exchange registrations / unsubscriptions in courses, course information, and user and teacher information between university systems. Bridges between the study management system and human learning computing environments can thus be interchangeable, working with either system. The PeopleSoft and SCT Banner Academic Management Systems, on the one hand, and Digital Learning Environments like Sakai, Moodle, and WebCT Vista, on the other, are some examples of environments that manage user identity, role and lists of access controls on educational resources with IMS Enterprise messages.

Sharing and Archiving Educational Material

The teaching material evolves over time, so the school is obliged to keep the references and the history of this material. The teaching material developed in a course can often be reused or adapted in another course. This material should therefore be constructed using the relevant standards to preserve, transfer and reuse.

The Addition of New Technopedagogical Tools to the Existing Human Learning Computing Environment

Human learning computing environments must constantly evolve, and very soon after they are put into production. Thus, we might want to add to a human learning computer environment, specialized techno pedagogical tools (exercisers, simulators, multimedia presenters) or simply to graft access to academic information specific to the learner: integrated university calendar, results academics, etc. Web-based lightweight standards exist for the use of complementary tools: web links, RSS feeds, inserting a frame into a Web page, Portlet. More complex standards allow for deeper integration. In particular, note that the SCORM standards, included in IMS Common Cartridge, and IMS Tool Interoperability provide methods, standards, and standards for sharing and reusing tools on human learning computing environment platforms. SCORM aims more "self-supporting" tools, which run in the browser on the local computer and communicate with the server by transmitting an XML message rich in information on the success or otherwise of a path or a quiz, while the IMS Tool Interoperability standard aims to collaborate complementary tools, but in different technologies on the server, for example written in PHP, Perl or .Net.

CONCLUSIONS

As a guide to the conclusion of this contribution, we are noting mainly based on university-level experiences that increasingly use human learning computer environments to achieve their mission of knowledge production and transmission. These environments require significant investments in technology, and even more in digital content. In this context, a great diversity of scientific digital arte facts of all kinds is generated by members of different institutions. Unfortunately, these investments in knowledge, knowledge, effort and public funding can depreciate very quickly if we do not ensure the durability of artifacts produced. To ensure long-term viability, use and reuse, it must be ensured that these will not be rendered unusable or lost due to technological obsolescence. Building teaching materials according to the standards recognized by the world of international university teaching will help guard against the accelerated aging of artifacts. As a result, it will protect the investments and efforts of all. In addition, the respect of open standards by human learning computing environments, will build a dynamic network effect for all players in university education. A diversified ecosystem can exist around this scholarly material. Individuals and specialized teams will be able to use or produce new content. Authors with new specialized tools will be able to add content, reuse existing material in new forms, or modify it.

Similarly, the integration of e-learning, is not a simple thing, we must recognize the difficulty of sharing highly nested applications. He wishes to emphasize that application sharing is especially promoted when joining a community (same development environment) making good use of standards and specifications specific to online training. Thus, let us underline on the international level, the tools of EIAH built with a modular and modern approach. In addition to the core product core, an open architecture allows extensions that come in the form of plug-ins. This facilitates the creation of open communities, around the basic product, and allows to add specialized modules specific to the specific needs of an institution or to develop new tools relatively easily.

Meanwhile, this vision must be reflected in a short, medium and long term path. Standards in the field of teaching materials are still young and will evolve significantly in the coming years. Some standards in the area of content, quizzes, their structure and organization as well as their metadata are proven and can be used now. Of particular note are the standards of SCORM 2004, IMS Content Packaging and IMS QTI. However, other specifications are still young and will mature in the next few years; note in particular the standards on the interoperation of technopedagogical tools such as IMS Tools Interoperability. Academic institutions will have to follow these developments closely and integrate these standards as they mature.

It is important that educational content produced for human learning computing environments respect the open formats and standards of e-learning. This means ensuring that specialized authoring tools are chosen based on their ability to produce standardized content, particularly with respect to the standards for portability of teaching materials (IMS Content Packaging, IMS QTI, SCORM 2004). It is also important for academic institutions to have a technological infrastructure capable of accommodating standardized pedagogical content from different sources (specialized authoring tools or existing courses produced in previous years). The separation between tools and infrastructure should allow more freedom in the creation of learning resources according to the discipline and the pedagogical approach favored by the trainer.

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